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PREVALENCE AND SOCIODEMOGRAPHIC CORRELATES OF OVERWEIGHT AND OBESITY AMONG SCHOOL-GOING ADOLESCENTS AGED 11–17 YEARS IN CENTRAL INDIA: A CROSS-SECTIONAL STUDY

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ABSTRACT **Background:** Adolescent overweight and obesity are increasing in India, but prevalence varies substantially across regions and socioeconomic settings. Objective: To estimate the prevalence of overweight and obesity and examine their sociodemographic correlates among school-going adolescents aged 11-17 years in Central India. **Methods:** This school-based cross-sectional study included 250 students selected from randomly chosen schools in Indore, Madhya Pradesh, between July 2024 and December 2025. Sociodemographic information was recorded using a pre-tested structured proforma. Height and weight were measured using calibrated equipment, body mass index (BMI) was calculated, and weight status was classified using the World Health Organization BMI-for-age reference. Associations between BMI category and age, sex, residence, socioeconomic status, and family type were assessed using the chi-square test. **Results:** The mean age was 14.07 ± 1.78 years; 123 (49.2%) participants were male, and 188 (75.2%) resided in rural areas. Overall, 55 (22.0%) adolescents were overweight and 45 (18.0%) were obese, giving a combined prevalence of 40.0%; 20 (8.0%) were underweight. BMI category was not associated with age group (p=0.551), sex (p=0.627), residence (p=0.108), or family type (p=0.434). Socioeconomic status was significantly associated with BMI category (p=0.018); overweight and obesity together affected 68.6% of adolescents in the upper socioeconomic group. **Conclusion:** Excess weight affected two in five adolescents in this school-based sample. The marked socioeconomic gradient identifies household affluence as an important contextual correlate and supports routine school-based BMI screening and prevention strategies across demographic groups.

KEYWORDS : Adolescent Obesity; Overweight; Prevalence; Socioeconomic Status; School Health

INTRODUCTION

Overweight and obesity during adolescence are defined using age- and sex-specific BMI references because body composition changes throughout growth. The World Health Organization (WHO) classifies overweight in children and adolescents aged 5-19 years as BMI-for-age greater than +1 standard deviation and obesity as greater than +2 standard deviations from the reference median [1]. The global burden has risen sharply: among people aged 5-19 years, the prevalence of overweight, including obesity, increased from approximately 8% in 1990 to more than 20% in 2022 [2]. Excess adiposity acquired during childhood is associated with early hypertension, dyslipidaemia, insulin resistance, and later cardiovascular disease [3].

India is experiencing this increase while undernutrition remains prevalent. The Comprehensive National Nutrition Survey reported overweight or obesity in approximately 4.8% of Indian adolescents aged 10-19 years [4], whereas regional school-based studies and meta-analyses have reported substantially higher estimates, particularly in urban and socioeconomically advantaged populations [5]. This coexistence of underweight and excess weight represents a double burden of malnutrition [6]. Differences in age structure, sex distribution, residence, family environment, socioeconomic status, and the BMI reference applied may contribute to the wide variation between studies [5,7]. Adolescence is a particularly important period for surveillance because rapid pubertal growth occurs alongside increasing independence in food choice, mobility, and leisure. Sociodemographic correlates can identify groups requiring intensified prevention, but their direction is not uniform across India and may change as urbanisation and household incomes evolve [5,7].

Regional data are needed because national averages may obscure local risk patterns during the nutritional transition. The present study was conducted to determine the prevalence of overweight and obesity among school-going adolescents aged 11-17 years and to assess the association of BMI category with age, sex, residence, socioeconomic status, and family type.

MATERIALS AND METHODS

This school-based cross-sectional study was conducted through the Department of Paediatrics, Index Medical College Hospital and Research Centre, Indore, Madhya Pradesh, from 1 July 2024 to 31 December 2025. The study population comprised school-going adolescents aged 11-17 years. Schools were selected randomly, and a population-proportionate sample of 250 students was recruited from the selected schools. Recruitment continued until the prespecified sample size was reached; no additional participants were enrolled.

All students aged 11-17 years were eligible. Adolescents with chronic illness, those receiving corticosteroid therapy, and those on any long-term drug treatment were excluded. Eligible participants were interviewed personally using a structured, pre-designed, and pre-tested study proforma. The interview schedule recorded age, sex, school standard, area of residence, socioeconomic status, and family type. Socioeconomic status was classified using the Modified Kuppuswamy method into upper, upper middle, lower middle, upper lower, and lower categories. Residence was recorded as rural or urban, and family structure as nuclear or joint.

Height was measured in centimetres using a calibrated digital stadiometer and weight in kilograms using a calibrated digital weighing scale, following a standardised procedure. Students were measured in light clothing without footwear, and equipment was checked before use. BMI was calculated as weight in kilograms divided by height in metres squared. Weight status was assigned using the WHO BMI-for-age reference: underweight below -2 SD, normal from -2 SD to +1 SD, overweight above +1 SD to +2 SD, and obesity above +2 SD [1]. Measurements and questionnaire data were recorded during the school visit and entered into the study master chart.

Data were entered in Microsoft Excel version 10.0 and analysed using SPSS version 20.0. Continuous variables were summarised as mean and standard deviation, and categorical variables as frequencies and percentages. Pearson's chi-square test was used to assess associations between sociodemographic variables and BMI category. All p values were two-sided, and $p<0.05$ was considered statistically significant. The study began after approval from the Institutional Ethics Committee. Participation was voluntary, consent was obtained before data collection, and confidentiality was maintained.

RESULTS

A total of 250 adolescents were included. Their mean age was 14.07 ± 1.78 years; 139 (55.6%) were aged 13-15 years. The sex distribution was nearly equal, with 123 (49.2%) males and 127 (50.8%) females. Most participants were from rural areas (188, 75.2%) and nuclear families (148, 59.2%). The socioeconomic distribution was broad, with the largest group in the upper-lower category (61, 24.4%) (Table 1). Mean height, weight, and BMI were 153.44 ± 9.48 cm, 54.20 ± 12.86 kg, and 22.95 ± 4.72 kg/m², respectively.

Table 1. Sociodemographic Profile of Study Participants (N=250)

Characteristic	Category	n (%)
Age group (years)	11-12	48 (19.2)
	13-15	139 (55.6)

	16-17	63 (25.2)
Sex	Male	123 (49.2)
	Female	127 (50.8)
Residence	Rural	188 (75.2)
	Urban	62 (24.8)
Socioeconomic status	Upper	35 (14.0)
	Upper middle	57 (22.8)
	Lower middle	57 (22.8)
	Upper lower	61 (24.4)
	Lower	40 (16.0)
Family type	Nuclear	148 (59.2)
	Joint	102 (40.8)

Data are presented as number (percentage).

Normal BMI was recorded in 130 (52.0%) participants. Fifty-five (22.0%) were overweight and 45 (18.0%) were obese, yielding a combined overweight and obesity prevalence of 40.0%. Underweight was present in 20 (8.0%) adolescents (Figure 1).

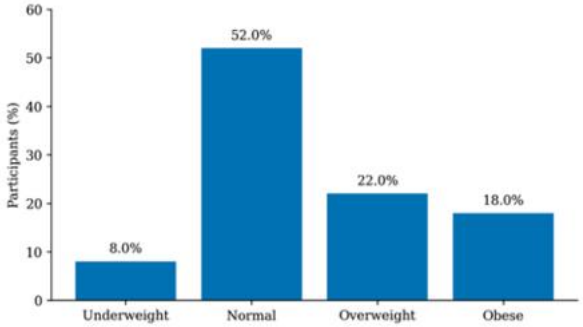

Figure 1. Distribution of Participants According to BMI Category.

BMI distribution did not differ significantly across age groups (chi-square=4.944, p=0.551). The combined prevalence of overweight and obesity was 41.7% among those aged 11-12 years, 41.7% among those aged 13-15 years, and 34.9% among those aged 16-17 years. No significant association was observed with sex (chi-square=1.747, p=0.627) or family type (chi-square=2.736, p=0.434) (Table 2).

Table 2. Association of Age, Sex, Family Type, and Socioeconomic Status with BMI Category

Category	Under-weight n (%)	Normal n (%)	Over-weight n (%)	Obese n (%)	Total	p value
Age group (years)	0.551					
11-12	3 (6.3)	25 (52.1)	9 (18.8)	11 (22.9)	48	
13-15	14 (10.1)	67 (48.2)	32 (23.0)	26 (18.7)	139	
16-17	3 (4.8)	38 (60.3)	14 (22.2)	8 (12.7)	63	
Sex	0.627					
Male	8 (6.5)	65 (52.8)	25 (20.3)	25 (20.3)	123	
Female	12 (9.4)	65 (51.2)	30 (23.6)	20 (15.8)	127	
Family type	0.434					
Nuclear	14 (9.5)	78 (52.7)	28 (18.9)	28 (18.9)	148	
Joint	6 (5.9)	52 (51.0)	27 (26.5)	17 (16.7)	102	
Socioeconomic status	0.018					
Upper	1 (2.9)	10 (28.6)	12 (34.3)	12 (34.3)	35	
Upper middle	6 (10.5)	24 (42.1)	14 (24.6)	13 (22.8)	57	
Lower middle	5 (8.8)	31 (54.4)	11 (19.3)	10 (17.5)	57	
Upper lower	6 (9.8)	41 (67.2)	9 (14.8)	5 (8.2)	61	
Lower	2 (5.0)	24 (60.0)	9 (22.5)	5 (12.5)	40	

Percentages are row percentages. p values were obtained using Pearson's chi-square test and are reported to three decimal places.

Socioeconomic status was significantly associated with BMI category (chi-square=24.444, p=0.018). In the upper socioeconomic group, 12 (34.3%) participants were overweight and 12 (34.3%) were obese, compared with 9 (14.8%) and 5 (8.2%), respectively, in the upper-lower group. Residence was not significantly associated with overall BMI distribution (chi-square=6.079, p=0.108), although obesity was recorded in 17 (27.4%) urban participants and 28 (14.9%) rural participants (Figure 2).

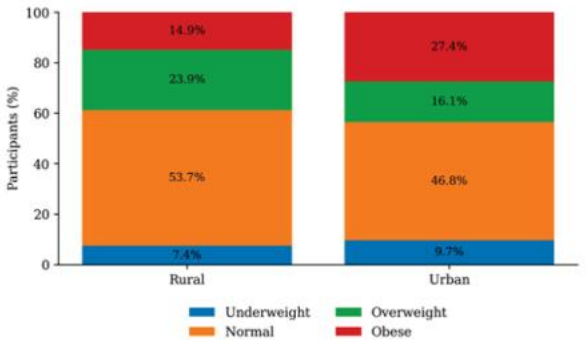

Figure 2. Distribution of BMI Categories According to Area of Residence.

Overall association between area of residence and BMI category: chi-square=6.079; p=0.108.

DISCUSSION

The study identified a substantial burden of excess weight among school-going adolescents in Central India. Two in five participants were either overweight or obese, while 8.0% were underweight. Among the sociodemographic variables examined, only socioeconomic status showed a statistically significant association with BMI category. Age, sex, residence, and family type were not significantly associated with weight status.

The combined prevalence of overweight and obesity was higher than the national estimate derived from the Comprehensive National Nutrition Survey [4] and higher than many earlier Indian school-based reports. Marwaha et al. reported overweight in 2.3% and obesity in 3.6% of schoolchildren in Delhi [8]. In an affluent Delhi cohort, Sharma et al. found 22% overweight and 6% obesity [9], while a four-city study by Gulati et al. reported a combined prevalence of 18% [10]. More recently, Ferozi et al. reported 19% overweight and 6% obesity among adolescents aged 12-15 years in Delhi [11]. Differences in study period, local food and activity environments, age composition, school selection, and BMI classification may account for some of the variation. Nevertheless, the present estimate indicates that excess weight is no longer confined to a small urban subgroup.

The coexistence of 8.0% underweight with 40.0% overweight or obesity illustrates the continuing double burden of adolescent malnutrition. Darling et al. documented 26.6% underweight and 4.6% overweight or obesity among rural adolescents in West Bengal [12], and Daga et al. similarly highlighted the presence of both forms of malnutrition among Indian schoolchildren [6]. The relative proportions vary across settings, but the public health implication is consistent: school nutrition programmes should avoid a single-focus approach and should identify both nutritional deficit and excess.

Age and sex were not associated with BMI category. Excess weight was distributed across early, middle, and late adolescence, and the combined prevalence was similar in boys and girls. Indian evidence on these variables has been heterogeneous. The national systematic review by Sharma et al. found substantial variation across age groups, sex, geography, and study methods [7]. The absence of a significant difference in the present sample suggests that screening based only on age or sex would miss a considerable proportion of affected adolescents. Universal assessment within the 11-17-year age range may therefore be more appropriate than selective screening.

The strongest sociodemographic finding was the socioeconomic gradient. More than two-thirds of adolescents in the upper socioeconomic group were overweight or obese, compared with 23.0% in the upper-lower group. Earlier Indian studies have linked higher parental education, family income, and household affluence with excess weight [8-10]. Ahmad et al. reported markedly higher odds of overweight and obesity among adolescent girls from higher socioeconomic groups [13], and Mohan et al. found high socioeconomic status strongly associated with obesity among adolescents in Punjab [14]. These findings are consistent with a phase of nutritional transition in which greater purchasing power, motorised transport, and access to energy-dense foods may coexist with reduced routine activity. Luhar et al., however, showed that the socioeconomic pattern of obesity in India is changing, with faster increases emerging

in lower and middle groups [15]. Prevention should therefore prioritise high-risk affluent groups without assuming that lower-income adolescents are protected.

Residence was not significantly associated with the overall BMI distribution, although the proportion with obesity was higher in urban than rural participants. Indian studies have generally reported a higher prevalence in urban settings [14,16], but the rural-urban gap may narrow as processed foods, sedentary recreation, and motorised transport become more widely available. The predominance of rural participants and the smaller urban subgroup may also have limited statistical power for this comparison. Family type was similarly unassociated with BMI, contrasting with the association between nuclear family structure and excess weight reported by Ahmad et al. [13]. Such differences probably reflect variation in household practices that cannot be captured by family structure alone. Thomas et al. also reported socioeconomic differences in overweight and obesity among schoolchildren in Mysuru [17].

These findings support routine BMI-for-age assessment in schools, coupled with counselling that is sensitive to socioeconomic context. The high prevalence across both sexes and all age groups argues for broad rather than narrowly targeted screening. Early identification is important because obesity during adolescence commonly persists into adulthood and carries long-term cardiometabolic consequences [3,18]. School health programmes can use repeated measurements to identify upward BMI trajectories, while referral pathways can be reserved for adolescents with obesity or associated clinical concerns.

LIMITATIONS

The cross-sectional design permits identification of associations but cannot establish temporal or causal relationships. The sample was limited to school-going adolescents from one region and was predominantly rural; adolescents not attending school and populations in other sociocultural settings may have different distributions. Sociodemographic information was questionnaire-based and may be affected by reporting error. BMI is a practical screening measure but does not distinguish fat mass from lean mass or describe fat distribution.

CONCLUSION

Overweight and obesity affected 40.0% of school-going adolescents aged 11-17 years in this Central Indian sample. BMI category was significantly associated with socioeconomic status, with the greatest burden in the upper socioeconomic group, but not with age, sex, residence, or family type. School-based surveillance should therefore include all adolescents while giving particular attention to the socioeconomic contexts associated with excess weight.

DECLARATIONS

Ethical Approval: Institutional Ethics Committee approval was obtained before initiation of the study.
Conflict of Interest: Nil.
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